Final Donlin Gold Project Assessment Review and Comments

Introduction

This report was completed by the Engineer Research and Development Center, Environmental Laboratory at the request of the USACE Regulatory Section and the Alaska Regulatory District. The purpose of the report was to review and comment on the Draft Wetland Functional Assessment Donlin Gold Project (Version 02, Revision 01; June 2014) prepared by Three Parameters Plus, Inc. (3PPI) as part of the regulatory permit process for the proposed Donlin Gold Project. The Alaska District identified four items for review and comment:

- 1) Review and evaluate the proposed wetland functional assessment methodology.
- 2) Compare the proposed methodology with other potential methodologies currently available.
- 3) Review the draft wetland functional assessment.
- 4) Review results of the draft wetland functional assessment.

Assessment Methodology

A wetland assessment was conducted by 3PPI of the area of the proposed Donlin mine site and proposed pipeline. The assessment was conducted using A Rapid Procedure for Assessing Wetland Functional Capacity: Based on Hydrogeomorphic (HGM) Classification (Magee and Hollands 1998, hereafter referred to as Magee-Hollands) including both on-site and off-site methods.

A key component that is lacking when trying to apply Magee-Hollands to interior Alaska is the absence of Reference Standard sites. Reference standard wetlands are the subset of minimally disturbed (Stoddard et al. 2006) reference wetlands, that by definition achieve the highest, sustainable levels of function, across the suite of functions ascribed to a regional wetland subclass (score of 1.0 for all variables and functions). Functional capacity is simply the ability of a wetland to perform a function compared to the top level of performance set by reference standard wetlands. The problem with using the Magee-Hollands method is that reference standard wetlands have not been established for the wetland classes being assessed in interior Alaska. The use of the Magee-Hollands method for a project in Alaska raises many concerns:

- 1. It was developed for the glaciated Northeast and Midwest, not interior Alaska.
- 2. It does not recognize the presence or importance of permafrost to the function of wetlands in interior Alaska.
- 3. There were no changes made to variables or functions for their application to interior Alaska.
- 4. Reference data was not collected in interior Alaska to provide appropriate scaling or calibration of variables.

- 5. Organic and mineral flats were combined in Magee-Hollands because they "function similarly." Organic and mineral flats do not function the same. This is why the Flats wetland class was divided into two separate (Mineral Flats and Organic Flats) wetlands hydrogeomorphic classes by Brinson in 1995.
- 6. The Magee-Hollands method only describes on-site methods, but off-site methods were used for much of the assessment area. Results of off-sites approach was not verified with field testing and comparison of results from on-site and off-sites results for the same site to provide any verification that the results from the two methods were similar. Without this type of comparison it is not possible to have confidence in the off-site results provided.
- 7. Magee-Hollands states that "...this procedure is not HGM" and "was developed for the glaciated northeast and midwest and can 1) be used as an example of a rapid assessment procedure and modified to make it applicable to other regions in the continental United States or refined for specific subregions by adding, deleting or modifying the functions, variables and variable conditions or by making other changes appropriate for the location, 2) provide a template for building regional HGM models, and 3) be used for conducting rapid wetland functional assessments in the glaciated northeast and midwest." Magee-Hollands method is not intended to be used in interior Alaska.
- 8. The Donlin Gold Project report states that "FCI (Functional Capacity Index) is an indicator of the capacity of a wetland to perform a function relative to other wetlands of the same HGM class in the project area." However, because the variables from Magee-Hollands were not scaled to interior Alaska wetlands, by using local data, the wetlands in the project area are being compared to wetlands of the northeast and midwest. Wetlands from interior Alaska likely function differently the wetlands of the northeast and midwest making the results inappropriate.
- 9. 3PPI "considered potential modifications, but determined that the wetland functions described in Magee-Hollands method were applicable to the Donlin Gold project area." However, no information is provided for how the Magee-Hollands method was determined to be appropriate for this project. If other methods were tested and results compared Magee-Hollands, then information should have been provided to justify the selection of Magee-Hollands.
- 10. Depressional and Flats wetlands are discussed together because they are identified in Magee-Hollands as having the same functions. Depressional and Flats wetlands do not function the same and using the same functions for both wetland classes is inappropriate. In many cases the landscape position and water source may be similar, but the hydrodynamics are typically different resulting in different subclasses (Brinson 1995). For example, depressional wetlands often store surface water for several weeks during most years while flats wetlands rarely have surface water for more than a few days.

- 11. Depressional and Flats wetlands are often not sources of ground water discharge. It would be necessary to evaluate depressional wetlands in interior Alaska to determine if the Modification of Ground Water Discharge is an appropriate function for this region. Calibration of reference data collected in the region would be necessary to determine if the function is appropriate for interior Alaska.
- 12. Depressional and Flats wetlands are often not sources of ground water recharge in areas of permafrost. Using the Magee-Hollands method in areas of naturally occurring permafrost would inappropriately lower scores for the Modification of Ground Water Recharge function.
- 13. Depressional and Flats wetlands typically store and sequester detritus and under natural conditions do not export large amounts of detritus. The Export of Detritus function is inappropriate for assessing the function of Depressional wetlands. When inappropriate functions are used to assess wetlands they may receive very low scores for the function even when they are functioning at a high self sustaining level.
- 14. Modification of Ground Water Discharge and Modification of Ground Water Recharge functions only vary by one variable. Modification of Ground Water Recharge uses the variable "Surface water level fluctuation of the wetland." It seems nearly impossible for a depressional or flats wetland to ever be reference standard for both of these functions. One or both of these functions would need to be eliminated based on data collected in interior Alaska for each wetland class.
- 15. The Modification of Stream Flow function is the multiplicative value of the Storm and Flood Water Storage and Modification of Groundwater Discharge functions. These two functions have the following variables in common:
 - a. Surface water level fluctuation of the wetland
 - b. Wetland water regime
 - c. Microrelief of wetland surface
 - d. Inlet/outlet class.

By combining the results of these two functions to create a separate function double counts the four variables listed above. It is not clear if the authors of the Magee-Hollands method intentionally weighted these four variables or if this was an oversight. Each variable should be considered for inclusion in the function based on data from interior Alaska and duplicate variables removed.

16. The Magee-Hollands method describes a condition where "if the wetland is seasonally fluctuating between recharge and discharge, the score should be reduced by one half (1/2)..." for both Modification of Ground Water Discharge and Modification of Ground Water Recharge functions. Magee-Hollands method does not provide clear guidance on how the user should make the measurement of seasonal recharge and discharge fluctuation. I could not determine if this seasonal fluctuation was used in the Donlin Gold Project assessment. Any application of Magee-Hollands should clearly state how this issue is addressed.

Variables

The Magee-Hollands method describes thirty-three (33) variables. Some variables are not included for use in any of the functions (e.g., Proportion of animal food plots). Other variables, such as Nested Piezometer Data can be used as direct indicators of function. However, this type of long term hydrology is typically not available and would rarely be used for a rapid functional assessment. Based on the information available, I could not determine if any of the direct measures of function were used in assessing the Donlin Gold Project report. The following nine variables (Table 1) are described in the method, but are not used in any of the assessment models for any wetland class.

Table 1. Variables described in Magee-Hollands but not used in assessment models	
Variable #	Variable Name
3	Fire occurrence and frequency
4	Regional scarcity
17	Nested piezometer data
18	Relationship of a wetland's substrate elevation to regional piezometric surface
19	Evidence of sedimentation
20	Evidence of seeps and springs
28	Proportion of animal food plants
32	Stream sinuosity
33	Presence of islands

Each of the variables described in Magee-Hollands is summarized below. Issues and problems with using the variables to assess wetlands in interior Alaska are also discussed. All information in this section relates to Magee-Hollands unless specifically identified as an issue related to the Donlin Gold Project data or report.

Landscape Variables

- 1. **Wetland size** This is a categorical variable that can be measured on-site if the wetlands are small or off-site for large or remote wetlands. This variable is only used in the Contribution to Abundance and Diversity of Wetland Fauna function. This variable should be scaled for interior AK and by wetland class.
- 2. **Wetland juxtaposition** This variable attempts to address surface water connection, isolation, and proximity to adjacent wetlands.
- 3. **Fire occurrence and frequency** Not used in any of the models.
- 4. **Regional scarcity** Not used in any of the models.
- 5. **Watershed land use** This is a common variable used in nearly all functional assessments and can be measured on-site or off-site. Magee-Hollands uses three (3) categories to assess this variable. This variable should receive the highest possible score for pre- project assessments throughout most of interior Alaska. I could not determine what score were used for the Donlin Gold Project.

Hydrologic Variables

- 6. **Surface water level fluctuation of the wetland** This variable is poorly defined and the description of how this variable should be measured is vague. For reasons that are not made clear, high fluctuation receives a higher score that low fluctuation. Without a clear definition and scaling based on data collected within each wetland class examined in interior Alaska this variable should not be used in the assessment.
- 7. **Frequency of overbank flooding** This variable is only appropriate for Riverine wetlands and should not be applied to Lacustrine Fringe or Flats wetlands.
- 8. **pH** This variable should not be used without data for each wetland class and scaled for interior Alaska. This variable receives a score of zero if no water is present at the time of sampling. This is inappropriate for wetlands that are inundated or saturated for short periods of time.
- 9. **Surficial geologic deposition under wetland** This is a poorly defined variable and is rarely impacted by typical wetland impacts. It is not appropriately scaled for conditions in interior Alaska including permafrost. **This variable as described in Magee-Hollands should not be used in interior Alaska**.
- 10. **Wetland land use** This is a useful variable that can usually be measured on-site or off-site. The Magee-Hollands method does not define the categories very well. This variable should received high scores for pre-project wetlands for most of interior Alaska.
- 11. **Wetland water regime** This variable makes the assumption that wetlands with a longer hydroperiod perform higher levels of wetland functions (i.e., wetter is better). To be useful, this variable should be scaled by wetland class for interior Alaska.
- 12. **Basin topographic gradient** To be useful, this variable should be scaled by wetland class for interior Alaska.
- 13. **Degree of outlet restriction** This variable only applies to Depressional and Flats wetlands. It is not explained how it applies to Flats and not Slope wetlands. This variable must be measured on-site. Data from interior Alaska should be used to verify the usefulness of this variable.
- 14. **Ratio of wetland to watershed area** Data from interior Alaska should be used to verify the usefulness of this variable.
- 15. **Microrelief of wetland surface** This variable must be measured in the field. It is not clear how this variable should be measured in the field. It appears that it is the height of hummocks. No guidance is provided for how many should be measured. This variable should be evaluated for the appropriateness for each wetland class and scaled for usage in interior Alaska.
- 16. **Inlet/outlet class** This variable assumes that wetlands with a longer hydroperiod perform higher levels of wetland functions (i.e., wetter is better). This variable should be verified and scaled based on data from interior Alaska. This variable is inappropriately used as an indicator of dysfunction for Flats wetland class.

- 17. **Nested piezometer data** This data was not available and was not used in the Donlin Gold Project assessment.
- 18. Relationship of a wetland's substrate elevation to regional piezometric surface This data was not available and was not used in the Donlin Project assessment.
- 19. **Evidence of sedimentation** This variable is not used in any of the models. It is considered a direct indicator of the Modification of Water Quality function. Direct evidence of sedimentation or the presence of a soil that classifies as a Fluvaquents receives the highest possible score for Modification of Water Quality function for all wetland classes. It seems that all Riverine wetlands that flood, even infrequently, would meet the highest possible score for this variable and Modification of Water Quality function.
- 20. **Evidence of seeps and springs** This variable should be verified and scaled for each appropriate wetland class based on data from interior Alaska. I could not determine if this variable was ever used in the assessment.

Soil Variables

21. **Soil type** – This variable only measures surface soil texture. To be useful it must be scaled based on data from interior Alaska for each wetland class.

Vegetation variables

- 22. **Dominant wetland type** This variable assumes that wetlands with forested vegetative cover function at a higher level than wetlands with emergent vegetative cover. This assumption would have to be verified and scaled based on data from interior Alaska for each wetland class.
- 23. **Number of wetland types and relative proportions** This is really two separate variables. The first variable is the number of vegetation types and the second variable is the evenness of distribution of the vegetation types. The measure of the second variable, evenness of distribution as described in Magee-Hollands is arbitrary and not useful for assessing wetland functions in interior Alaska.
- 24. **Vegetation density/dominance** An appropriate variable for all wetland classes if scaled for interior Alaska.
- 25. **Vegetative interspersion** The measurement of this variable is not adequately explained in the Magee-Hollands method. Measurement would be arbitrary and difficult to verify.
- 26. **Number of layers and percent cover** This is really two separate variables. The first variable is the number of vegetation layers and the second variable percent cover for all of the vegetation layers. This variable assumes that the greater numbers of layers or strata that are present and greater percentage of cover reflects a higher level of function.

This is not always true. Naturally occurring herbaceous wetlands often have only one or two strata. This variable is not useful without verification and scaling for interior Alaska by wetland class.

- 27. **Plant species diversity** This variable should be verified and scaled for each appropriate wetland class based on data from interior Alaska. Donlin's FA groups plant species diversity in Low (0-9 vascular species), Medium (10-18 vascular species), and High >18 vascular species). It appears this ranking is applied across the various wetland subclasses without supporting field data. This ranking may not apply to emergent wetlands in the same manner applicable to a closed forested wetland with well defined strata.
- 28. Proportion of animal food plants Not used
- 29. **Cover distribution** An appropriate variable for all wetland classes if scaled for interior Alaska.
- 30. **Dead woody material** This variable is inappropriate for wetlands that are not naturally dominated by forest. This variable should be verified for each appropriate wetland class based on data collected and scaled in interior Alaska.
- 31. **Interspersion of vegetation cover and open water** Some wetland classes naturally have little or no open water. This variable should not be used without supporting data and appropriate scaling based on data from interior Alaska.
- 32. Stream sinuosity Not used
- 33. **Presence of islands** Not used

Other Available Methods

The Operational Draft Guidebook for Reference Based Assessment of the Functions of Precipitation-Driven Wetlands on Discontinuous Permafrost in Interior Alaska (State of Alaska Department of Environmental Conservation 1999) is an assessment method based on the principles of the Hydrogeomorphic (HGM) Approach. The variables in this method are scaled based on field data collected in interior Alaska. Since this method was developed specifically for interior Alaska it does not incorporate variables and functions that are inappropriate inclusions from the Northeast and Midwest region as described by Magee-Hollands. The consulting firm 3PPI was aware of the Interior Alaska method, but did not explain why this method was not used for the assessment.

Draft Wetland Functional Assessment Results

Items 3) Review the draft wetland functional assessment and 4) Review results of the draft wetland functional assessment, of the Corps District request, could not be completed. It was not possible to verify what variables were used in the Donlin Gold Project assessment, what variable values were assigned for a specific field site, or models (equations) were used to calculate the FCI results. Without specific variable data for multiple sites for each wetland class assessed it

was not possible to track the numbers in the report to determine if the FCI results were accurate using the Magee-Hollands method. Review of the FCI scores showed that no sites met the definition of reference standard condition (all variable and functions scores equal 1.0). The lack of reference standard wetlands in an area of Alaska with very few human impacts supports the idea that the Magee-Hollands method is inappropriate to assess wetland functions in interior Alaska.

Recommendations

The following recommendation options are based on my review of Magee-Hollands and the Donlin Gold Project report.

Wetlands within the impact areas of the project need to be delineated following the protocols described in the US Army Corps of Engineers Wetland Delineation Manual and the Alaska Regional Supplement. Based upon the limited amount of wetland delineation data reviewed, it is my impression that the mosaic approach to wetland delineation is not being used correctly.

Do not use Magee-Hollands to assess wetland function if interior Alaska.

If Magee-Hollands is used then the following changes need to be addressed:

- 1. Remove inappropriate variables.
- 2. Remove inappropriate functions.
- 3. Rescale variables based on data from interior Alaska.
- 4. Adjust function models or equations based on the variables used.

If off-site methods are used, they should only be applied to areas with minor impacts, indirect impacts, or no impacts. Results from off-site methods should be compared to a subsample of areas where on-site data collection occurred to demonstrate that results from off-site methods are similar, reasonable and appropriate for the wetland class being assessed.

Sample calculation of FCIs and FCUs by function and polygon and wetland class should be provided.

Do not use average results. The District might want to consider accepting weighted average scores by wetland class.

Explore the use of *The Operational Draft Guidebook for Reference Based Assessment of the Functions of Precipitation-Driven Wetlands on Discontinuous Permafrost in Interior Alaska* (State of Alaska Department of Environmental Conservation 1999)

Summary

The use of variables and functions that do not apply to some wetland classes and the lack of variable scaling based on data collected in interior Alaska make the Magee-Hollands wetland assessment method inappropriate for use in interior Alaska. Magee-Hollands would need major modifications to adjust the method to the region, including variable scaling to adjust for

reference standard conditions and evaluation of all variables and functions based on data from interior Alaska for each wetland class.

References

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